I Claim:

- 1. A permutation switch for switching wavelength-division multiplexed signals received from one or more optical waveguides, comprising:
 - (a) a substrate having at least one surface;
- (b) a single-mode to multi-mode backward coupler, coupled to said surface of said substrate, for receiving single-mode wavelength division multiplexed signals from said optical waveguides, and for backward coupling said signals into a plurality of single-mode signals, each having its own unique mode.
- 2. The switch of Claim 1, wherein said single-mode to multi-mode backward coupler further comprises:
- (a) a receiving layer, coupled to said substrate surface, for receiving said single-mode wavelength-division multiplexed signals;
- (b) a separation layer having a first surface and a second surface, said first surface coupled to said receiving layer, for permitting said backward coupling between said single-mode wavelength-division multiplexed signal and said plurality of single-mode signals; and;
- (c) a multi-mode waveguide, coupled to said second surface of said separation layer, for receiving said backward coupled plurality of single-mode signals.
- 3. The switch of Claim 2, wherein said separation layer further comprises a grating portion etched into said second surface of said separation layer, for phase-

matching a channel of said wavelength-division multiplexed signal to one of said plurality of single-mode signals.

- 4. The switch of Claim 2, wherein said multi-mode waveguide further comprises a grating etched into a surface thereof for phase-matching a channel of said wavelength-division multiplexed signal to one of said plurality of single-mode signals, wherein said grating is coupled to said second surfaceof said separation layer.
- 5. The switch of Claim 2, wherein said wavelength division multiplexed signals comprise asynchronous signals.
- 6. The switch of Claim 2, wherein said single-mode signals comprise asynchronous signals.
- 7. The switch of Claim 2, wherein said separation layer is adapted to minimize a modal-field overlap.
- 8. The switch of Claim 2, wherein said single-mode to multi-mode backward coupler further comprises a plurality of output waveguides, each coupled to said multi-mode waveguide and receivingone of said plurality of single-mode signals.

- 9. The switch of Claim 8, wherein said plurality of output waveguides are distributed adiabatically.
- 10. The switch of Claim 2, wherein said receiving layer further includes an inverted rib portion having a predetermined width for propagating said single-mode wavelength division multiplexed signals.
- 11. The switch of Claim 10, wherein said multi-mode waveguide further includes a rib portion having a predetermined width, and wherein said predetermined width of said inverted rib of said receiving layer is less than said predetermined width of said rib of said multi-mode waveguide.
- 12. The switch of Claim 11, wherein said inverted rib portion of said receiving layer is offset from said rib portion of said mullti-mode waveguide.
- 13. The switch of Claim 11, wherein inverted rib portion of said receiving layer is alligned with an edge of said rib portion of said multi-mode waveguide.
- 14. The switch of Claim 2, wherein each of said output waveguides further includes a multiple-quantum well layer.

- 15. The switch of Claim 14, wherein said multiple quantum well layer comprises InGaAsP/InP.
- 16. The switch of Claim 8, further comprising a plurality of electrodes, each one mounted on one of said plurality of output waveguides.
 - 17. The switch of Claim 16, wherein said plurality of electrodes are tapered.
- 18. The switch of Claim 14, wherein each of said plurality of output waveguides are sized to be much smaller than corresponding absorption lengths.
- 19. The switch of Claim 2, wherein said multi-mode layer is adapted to receive all of said backward coupled signals in sequential modes.
- 20. The switch of Claim 2, wherein said multi-mode waveguide is adapted to receive all of said backward coupled signals in even-ordered modes.
- 21. A method for switching wavelength-division multiplexed signals, comprising the steps of:
- (a) receiving from one or more single-mode wavelength division multiplexed signals;

- (b) backward coupling said received signals into a plurality of single-mode signals, each having its own unique mode; and
 - (c) switching said plurality of single-mode signals into separate channels.
- 22. The method of Claim 21, wherein said backward coupling further includes phase-matching a channel of said wavelength-division multiplexed signal to one of said plurality of single-mode signals.
- 23. The method of Claim 21, wherein said wavelength division multiplexed signals comprise asynchronous signals.
- 24. The method of Claim 21, wherein said single-mode signals comprise asynchronous signals.
- 25. The method of Claim 21, wherein said backward coupling is adapted to minimize a modal-field overlap.
- 26. The method of Claim 21, wherein said switching step comprises switching said plurality of single-mode signals into adiabatically distributed channels.

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- 27. The method of Claim 21, wherein said backward coupling step further comprises propagating said single-mode wavelength division multiplexed signals in an inverted rib which is aligned with a rib of a multi-mode waveguide.
- 28. The method of Claim 21, wherein said backward coupling step is adapted to couple all of said backward coupled signals in sequential modes.
- 29. The method of Claim 21, wherein said backward coupling step is adapted to couple all of said backward coupled signals in even-ordered modes.
- 30. An add/drop multiplexer system for adding and dropping unequally spaced channels of a single-mode waveguide, comprising:
 - (a) a substrate having at least a first surface;
- (b) a plurality of siongle-mode waveguides having unequally spaced channels mounted on said first surface;
- (c) a common single-mode to multi-mode waveguide grating-assisted backward-coupler, mounted on said first surface of said substrate and optically coupled to each of said plurality of single mode waveguides; and
- (d) a plurality of digital optical switches, each having a plurality of output waveguides, optically coupled with said plurality of multi-mode waveguides.